Studies in Systems, Decision and Control 529

Rostyslav Shchokin
Anna Iatsyshyn
Valeriia Kovach
Artur Zaporozhets *Editors*

Digital Technologies in Education

Selected Cases

Springer

Studies in Systems, Decision and Control

Volume 529

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Editors

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Editors
Rostyslav Shchokin
Interregional Academy of Personnel Management
Kyiv, Ukraine

Valeriia Kovach
Center for Information-Analytical and Technical Support of Nuclear Power Facilities Monitoring
National Aviation University
Kyiv, Ukraine

Anna Iatsyshyn
Institute for Digitalisation of Education of the National Academy of Educational Sciences of Ukraine
Kyiv, Ukraine

Artur Zaporozhets
General Energy Institute of NAS of Ukraine
Kyiv, Ukraine

ISSN 2198-4182 ISSN 2198-4190 (electronic)
Studies in Systems, Decision and Control
ISBN 978-3-031-57421-4 ISBN 978-3-031-57422-1 (eBook)
https://doi.org/10.1007/978-3-031-57422-1

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Paper in this product is recyclable.

Preface

Digital technologies are actively changing the modern world. These technologies are implemented and integrated into all spheres of human activity and society, becoming a powerful catalyst and a determining source of social development. According to such a development scenario, the organization acquires defining digital technologies as its leading technology. This process is called the digital transformation of society.

The wide use of digital technologies to provide free access to information and knowledge is a fundamental principle of the digital society. But here, we shouldn't forget about knowledge management in such a society—a collection of methods relating to creating, sharing, using, and managing the knowledge and information of an organization. It refers to a multidisciplinary approach to achieving organizational objectives using the best knowledge. Digital society significantly changes traditional ideas about work, education, science, culture, communication, and social and political life. The development of citizens' digital culture is the primary condition for the successful existence of the digital society and the implementation of good knowledge management practices. Therefore, it is essential to carry out scientific research and targeted training to improve the qualifications of specialists in various branches of the economy, in particular, educators and scientists, to acquire competencies: digital and management. After all, these specialists are critical in ensuring the knowledge management digitalization process as part of education (e-learning, teaching) and science development.

The main functions of knowledge management are as follows:

- The analytical function ensures the search, selection, and analysis of initial data and information; the choice of effective information resources; and the synthesis of gathered information.
- The distributive function contributes to organizing knowledge, assessing its usefulness, classifying it based on specific criteria, and incorporating classified knowledge into corporate memory.
- The integrative function aims at exchanging knowledge and experience among structural units (interaction between universities, research institutions, businesses, and the public).

- The protective function creates barriers to safeguard knowledge and information from the unauthorized leakage of personal information about students, faculty, and researchers.
- The function of generating new knowledge is based on scientific research, experiments, understanding societal needs regarding the relevance of educational programs, and feedback from the public.

The concept of knowledge management encompasses two possible strategies. The first strategy focuses on education, development of creative and intellectual abilities of all participants in the educational and scientific process, exchange of experience, knowledge, and communication. The second strategy aims at creating and developing corporate management systems using modern information technologies, which requires careful design of procedures, technical, and software support. Particularly promising are strategies aimed at developing intellectual property through effective management of intellectual assets such as patents, licenses, copyrights, authorship certificates, author's specialized educational courses, and others.

Large-scale digitization of all social sectors, quarantine restrictions caused by the COVID-19 pandemic, and martial law imposed on Ukraine's entire territory starting in February 2022 forced managers at different levels to use more actively various digital technologies and systems. In the form of knowledge management trends, the educational and scientific spheres should take leading positions and be role models for using digital technologies. This especially applies to training future specialists in various fields of knowledge. It was the baseline for choosing the book chapters explaining how to orient the educational system in extreme conditions and using the best knowledge management practices to make educational institutions more substantial, efficient, and autonomous. Digitization of education is one of the necessary conditions for the successful development of the processes of digital transformation of society, a part of the knowledge management trend because it forms the background to prepare such specialists, independent individuals who will shape innovative digital surrounding and will feel free and confident in it.

Currently, knowledge management becomes particularly important as digital technologies provide new opportunities for information collection, analysis, storage, and dissemination. Digital tools help improve knowledge management processes, facilitate quick access to up-to-date information, foster collaboration on projects, ensure information preservation and transfer, and enable the engagement of experts from various fields and the dissemination of best practices. Together, the digitization of education and science and knowledge management contribute to enhancing the quality of learning, scientific research, and innovative development.

Digitalization and knowledge management are two interconnected concepts that contribute to the development and improvement of education, science, and organizational management. Digitalization enables the creation of digital databases, electronic libraries, e-learning systems, collaborative platforms, and other tools that facilitate knowledge management. In turn, knowledge management promotes the effective use of digital technologies and resources in educational and scientific processes. It focuses on organizing knowledge, developing databases, designing classification and

information retrieval systems, as well as supporting collaboration, communication, and knowledge exchange among participants in the educational environment. Digitalization and knowledge management are interrelated and complement each other. Digital technologies provide the infrastructure for knowledge storage and dissemination, while knowledge management helps organize, structure, and efficiently utilize this information. Together, they contribute to improving the quality of learning, scientific research, and innovative development, creating conditions for effective knowledge utilization and supporting lifelong learning and development in the modern digital world.

The book presents various aspects of the digital transformation of education and science as a part of the knowledge management system, describing knowledge management as an innovative instrument and trend in the digital transformation of society. A comprehensive view of the current state and prospects of using digital technologies for knowledge management is presented. The selection process was oriented to show the ongoing processes through the public management perspective, the competencies needed for new educational managers, innovative technology implementation, and psychological readiness to percept them in the increased stress environment. Also were added papers highlighting the ability of students, early career researchers, and Ph.D. students to cope with the new reality and find positive outcomes and ready solutions to develop and use the obtained knowledge in practice. The experience of using digital technologies and tools for training and improving the qualifications of specialists and preparing future Ph.Ds. is described separately for a better understanding of the transformation process of Ukrainian science.

This book presents theoretical and practical features of knowledge management digital transformation (from the point of view of education and science development), formed by a team of authors from various scientific institutions and universities of Ukraine and Poland. Among the authors of the book are employees of: Interregional Academy of Personnel Management, Institute for Digitalisation of Education of the National Academy of Educational Sciences of Ukraine, Sumy State Pedagogical University named after A. S. Makarenko, National Aviation University, State Institution "The Institute of Environmental Geochemistry of National Academy of Sciences of Ukraine", Bila Tserkva National Agrarian University, Ukrainian Institute of Scientific and Technical Expertise and Information, Institute of Socio-Economic Geography and Spatial Management University of Gdańsk, Shupyk National Healthcare University of Ukraine, Taras Shevchenko National University of Kyiv, National University of Civil Defence of Ukraine, National University of Life and Environmental Sciences of Ukraine, Academician Yuri Bugay International University of Science and Technology, Academy of Science the Public Administration, Bogomolets National Medical University, Dragomanov National Pedagogical University, Educational and Scientific Institute "Institute of Public Administration" of V. N. Karazin Kharkiv National University, Institute for Social and Political Psychology of the National Academy of Educational Sciences of Ukraine, Institute of General Energy of National Academy of Sciences of Ukraine, Ivano Frankivsk National Technical University of Oil and Gas, Kyiv Medical University, National Defense University of Ukraine named after

Ivan Cherniakhovskyi, National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", and National University "Zaporizhzhia Polytechnic".

The contents of practically all chapters concern various education-related problems and issues which are universally relevant and concern the new situation that happens around the world in relation to new disruptive technological changes that have been observed over the last years. They are related to what many people describe as Industrial Revolution 4.0 (or even 5.0) which has started implying serious changes in all areas of human activities, notably in education. However, the unprecedented and tragic war in Ukraine has clearly caused some unexpected problems and challenges in all kinds of economic, social, technological, educational, etc. aspects, and they are considered and thoroughly analyzed in many papers in this volume.

In the first part *Digital Transformations in Education: Implementing New Knowledge Management Strategies* the following topics are examined: digitization as a global trend in modernizing public management systems, the role of educational organization leaders, the readiness of educational managers and teachers for improving distance education and knowledge management, and the functioning of learning factories in the era of digital transformations.

In the second part *Unleashing Potential: Knowledge Management and Digital Technologies in Higher Education* the following topics were discussed: trends of digitalization in higher education, innovative educational and production laboratories, implementation of chatbots in the education system for knowledge management, peculiarities of preparing children and youth for work in the field of robotics, psychological techniques for overcoming war-related stress in Ukrainian students, and more.

In the third part *Digital Technologies for Scientists' Advanced Training* the following topics were discussed: requirements of the digital society for scientists' information-analytical competence, peculiarities of using digital technologies to instill a sense of ownership in young researchers at the beginning of their scientific career, and the specifics of knowledge management and professional development in the context of digital transformation in education and science in Ukraine.

In the fourth part *Knowledge Management in the Educational Space: Aspects of Information Security* the following topics were discussed: the role of online encyclopedias in knowledge management and preservation of Ukrainian cultural heritage, the peculiarities of personal security as an integral component of sustainable societal and state development, and the directions for the use of artificial intelligence technologies in education.

The process of reviewing this collective monograph involved several stages that allowed for the evaluation of the quality and scientific value of the research presented in the monograph. Firstly, all editors jointly discussed the materials included in this monograph and distributed them into respective sections. Secondly, cross-reviewing and editing of the sections were conducted. Editors reviewed the chapters where they did not have their own submitted materials, which enabled an objective assessment of the scientific findings included in this monograph. Rostyslav Shchokin edited in

the first part, Anna Iatsyshyn edited in the second part, Artur Zaporozhets edited in the third part, and Valeriia Kovach edited in the fourth part. Artur Zaporozhets and Valeriia Kovach initiated and developed the idea of preparing this monograph.

Kyiv, Ukraine
November 2022

Rostyslav Shchokin
Anna Iatsyshyn
Valeriia Kovach
Artur Zaporozhets

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Digital Transformations in Education: Implementing New Knowledge Management Strategies

Digitalization as a Global Trend of Public Management Systems Modernization

Viacheslav Shandryk, Oleksandr Radchenko, Oksana Radchenko, Artem Koshelenko, and Iryna Deinega

Abstract Conceptual view genesis of social phenomenon of the digitalization of public management systems of the modern world is studied. It is substantiated that new understanding of essence of the public governance processes is emerging in the conditions of the transition of humanity to the era of the information society. This is not based on bureaucratic administration or even client-oriented approach of "service state", this is based on the vision of public administration bodies system as a digital technological platform of network interconnections relations and interactions of the state, its institutions, citizens and civil society organizations. Content and essence of the main stages of the transition from the "New State Administration" to more modern "digital" administration based on "customer-oriented" integrity and the wide application of information and communication technologies are revealed. It includes stage of digitization and stage of digital transformation.

Keywords Global information space · State · Public administration · Digitalization · Digital transformation

V. Shandryk · I. Deinega
National Aviation University, Kyiv, Ukraine

O. Radchenko (✉)
Institute of Socio-Economic Geography and Spatial Management, University of Gdańsk, Gdańsk, Poland
e-mail: radchenko@o2.pl

O. Radchenko
Educational and Scientific Institute "Institute of Public Administration" of V. N. Karazin Kharkiv National University, Kharkiv, Ukraine

A. Koshelenko
Academician Yuri Bugay International University of Science and Technology, Kyiv, Ukraine

I. Deinega
Center for Information-analytical and Technical Support of Nuclear Power Facilities Monitoring of the National Academy of Sciences of Ukraine, Kyiv, Ukraine

R. Shchokin et al. (eds.), *Digital Technologies in Education*, Studies in Systems, Decision and Control 529, https://doi.org/10.1007/978-3-031-57422-1_1

1 The Problem Statement

The modern world is rapidly entering the era of information society or "knowledge society". There the main role is played by information management. Purposeful transformation of national public administration systems on a digital basis is a global world trend. Leading countries consider digitization as a certain driver of new paradigms and concepts of public governance and priority nationwide strategic task. So, digital transformation is changes essence taking place in the development of society. It covered all countries, all spheres of social and human life and became the task and direction of social and economic progress. This process, this phenomenon today has a certain number of names—digitalization, digital globalization, Industry 4.0 (Germany), Society 5.0. (Japan) [1, 2]. These and other terms have relevant rationales reflecting shifts in human history that cannot be ignored [3].

New understanding of the essence of public governance processes is emerged in the new digital world. This is not based on bureaucratic administration or even client-oriented approach of the "service state". This is based on the vision of the system of public administration bodies as a digital technological platform of network interconnections and interactions of the state, its institutions, citizens and civil society organizations. Corresponding transformations of public governance systems take place in the format of digitizing procedures and documents of current activities. It converts significant part of them into the format of electronic services, forming large databases and operating them—spreading phenomenon of digitalization in its broadest sense. Digitalization processes first spread widely in the business environment, quickly covered the media and communication sphere. It increasingly entered space of state administration and local self-government in full compliance with the sequence of transformation algorithm of public-power relations. Therefore, introduction of innovative information and communication (digital) technologies and development of digital management elements is considered in most countries of the modern world as one of national priority strategic tasks. Digital technologies, related management and public activities form digital sphere of modern society. Its economic and innovative potential, social progress, management efficiency, the implementation of democratic procedures, education, the level of human development, national security and defense capability are depended [4–7].

Digitization as a globalization nature process brings to states new opportunities for "leaping transition" to a new civilizational formation and new threats to national sovereignty in national security. Thus, study of genesis, conceptual foundations and main aspects of digitization is relevant both from academic and scientific point of view. From managerial and applied point of view the need is urgent both for state institutions and for society as a whole.

2 Main Material Presentation

The history of mankind is the history of evolution and transformation of activities organization of human communities, interpersonal and social-power interactions, corresponding to certain noospheric-historical conditions. Historical experience shows that every time such organization of public, political life, relative power structures and civil society is changed significantly with development of new technologies. Revolutionary technological leaps always lead to revolutionary changes in socio-economic infrastructure of life, in power-society interaction and in organization of public administration systems. At the same time new technologies are always first mastered by the economic and production sector. Changes in technology lead to changes in social relations. These changes ultimately lead to changes in power-social relations, organization of state-organized life and activities of public governance institutions. Current stage of civilizational development of humanity is quickly covered by the media and communication sphere and is increasingly entering the space of state administration and local self-government. There digitization processes first spread widely in the business [8, 9].

In the modern public discourse there is a widespread belief that "digitalization", information and communication technologies are not new separate industry. It is essentially new way of life, new basis for development of the state administration system, economy, business, social sphere and entire society. Transition to digital governance will contribute to "leap-like" development, i.e. transition of society, the state to higher level of development, bypassing certain intermediate stages. Therefore, today "leap-like" development actually does not have alternatives in the "digital" world. Since any state (that does not modernize its activities (primarily management) through the introduction of new technologies and innovations) can not participate in the formation of the main economic trends in the world and inhibits the development of society. National governments adopt strategic documents in order to implement the process of digital transformations (transformations) at the state level. The documents are often called "digital agenda" or "digital strategy" [10].

The new digital age in the context of public administration science requires fundamental transformation of traditional public administration systems. Outdated and archaic principles of the state transformation into public administration through administration and establishment of prohibitions should remain in the past. Competitive economy cannot be built by intensifying struggle, prohibitions, threats and effective development. It was proven by scientists and practitioners. Democratic dialogue possibility between the government and citizen, strengthening possibilities of public control through appeals of decisions and management services of public authorities should be recipe for further transformations. It is necessary to change structure and algorithm of management mechanisms [11].

It is worth noting that transition to the informational "digital society" is extremely rapid and turbulent in historical terms. This process directly takes place during the last 30–50 years. Scientists find its origins in the depths of ages. Thus, scientists count the "first information revolution" from the biblical "In the beginning there was the word".

In fact, use of word by mankind became in fact the first Information Revolution. It started point of our next absolute domination on the planet. Knowledge is framed in words and sentences from the beginning of language. Information was already one of the strongest sources of power [12]. In turn, the German researcher Martin Burckhardt dates the beginning of digitization from 1746. In the same time Abbot Jean-Antoine Nollet first carried out an experiment on the instantaneous transmission of electric current from the Leyden Bank over a distance of 600 m [13].

However, the concept of "Digital Era Governance" was first proposed in 1991 by P. Dunlevy, H. Margets, S. Bastow and J. Tinkler from a purely scientific point of view. It was a transition from the "New Public Administration" (New Public Management) to more modern "digital" management based on "customer-oriented" integrity (holism—is a philosophy of integrity underlying the reorganization of management to meet needs of all client groups) and digitalization (using the potential of digital storage of information and digital communications for transformation management) [14].

Such transition over the past thirty years occurred in three main stages.

The first stage is referred to digitization. In essence it is introduction of processes of transferring business information from analog to digital format in state structures. In Ukraine this stage is mostly called the informatization stage. During this stage information and communication technologies were widely used in public administration structures primarily for operational actions related to searching, selecting, obtaining, accumulating the necessary information, its registration, storage, processing, transformation, destruction, renewal, transmission, duplication, distribution, etc.

The second stage is referred as digitalization. It determines the large-scale introduction of digital data and tools into the current activities of public administration bodies, primarily into document circulation.

This is the stage of creation and operation of a fundamentally new tool of public administration—"electronic government". Goal of e-governance is to improve the efficiency of the work of authorities with citizens, enterprises and other institutions and to reduce the joint costs of time and money [15]. It is transitioned into a digitized form. G. and M. Razumey noted that "Ukraine began to introduce elements of electronic governance back in 2003 through the "Electronic Government" information system and a number of regulatory acts. They were never fully implemented. However, it can be stated that significant steps were not taken in 2010. It did not happen even after the adoption of the Concept of the development of e-governance in Ukraine despite the existence of separate specialized bodies: the National Center for the Support of e-governance and later the State Agency for e-governance of Ukraine" [15].

The third stage in European sources was called "Digital Agenda" (digital transformation). It is logical continuation of evolutionary development of information and communication technologies based only on digital (discrete) signals. This creates wide opportunities for development and introduction of online platforms for effective development of digital governance by state structures. This stage symbolizes transition from the modern model of New Public Management to the "Digital Era Governance" (Digital Era Governance). It is designed to "qualitatively change the content

of public administration, including individual procedures, stages of the management cycle, state functions, their composition and types. Such change should lead to increase in quality, efficiency and effectiveness of state authorities and management. It provides greater justification for state intervention and redue general role of the state as a whole" [16].

Digitization changes system of public governance as an organized set of central and regional bodies of state executive power, regional, district and local self-government bodies. These bodies created to implement the state functions of ordering and regulating the socio-political, economic and cultural and spiritual life of the population, to provide appropriate public and administrative services within the framework of the Constitution and legislative acts of the state. This system is transformed from hierarchical-vertical and horizontal-network system under the influence of digitalization. Such situation fundamentally changes power-administrative relations between individual institutions of public governance, within these institutions themselves, their mutual relations and interaction with the economic and industrial sector and institutions of civil society.

Such transformation includes number of key processes:

- decentralization of power. Such process is accompanied by number of state functions and powers transfer to lower level of authority. It occurs simultaneously in two opposing directions: actual transfer of power from the top down, from state bodies to local self-government and from the bottom up when local municipalities independently take certain functions by the principle of subsidiarity that they are able to implement more effectively than the state;
- quality and speed improving of public administrative services provision to citizens due to the transfer of significant part of them into an electronic, automated format, elimination of the human factor and potential bureaucratic arbitrariness due to the removal of civil servants from the chain of providing administrative services;
- efficiency increasing of the budget funds use associated with release of a considerable part of employees of public administration bodies who previously performed functions of receiving citizens, their appeals, requests and statements regarding the provision of administrative services. This makes possible to optimize personnel composition, ensure flexibility of professional competences use of management apparatus of state executive authorities and local self-government bodies;
- bringing of preparation and adoption of public-management decisions to fundamentally new level the processes as a result of the latest information and communication technologies use, development of electronic and digital databases, software capable of operating large information arrays and calculating various possible consequences of management decisions after their adoption and implementation;
- formation of fundamentally new system of interaction between public administration bodies, institutions of civil society, citizens and principles of partnership interaction and broad participation in local government through online services for the formation of local budgets and monitoring of their implementation;
- transition from administrative-command management to client-oriented management aimed at obtaining expected result as result of changing philosophy of public

administration bodies functioning to focus on people-centeredness and improving quality of life of citizens of this specific administrative-territorial unit.

Digitalization advantages of public administration systems and state regulation of the economy are significant and obvious. These advantages include:

- New opportunities creation for social development based on the latest technologies use (mobile networks, social technologies, big data analysis, "cloud" computing). It increases potential for new values forming of institutions and organizations, attracting new customers, etc.
- Increasing of competitiveness of the national economy through the introduction and development of new business models and technologies (analytics of large data sets, digital platforms, robotics, 3D printing, Internet of Things, neural networks, artificial intelligence, blockchain, etc.).
- Increasing transparency of the interaction process between corporate sector and population with the state. It will cause the improvement of the business climate in the country (procedures simplification for the provision of the following public services: declaring taxes, obtaining permits, legal entity registering, developing of electronic services system for business and online services).
- Increasing of the state funding amount in the field of education and science, training professional personnel in the field of IT, creating retraining centers and adaptation programs for personnel.
- Implementation of measures aimed at improving quality and convenience of obtaining medical, educational, cultural, transport services, services in the field of public safety.
- Regulatory regime easing, development of uniform standards in the field of digital technology use, creation of special legal regimes for pilot projects.
- Stimulation of interest in the use of digital innovations and the development of digital culture [17].
- Rapid development of information and communication technologies use in the administrative activities of public administration bodies. It allows to accelerate, systematize and coordinate search for necessary management information, its circulation, processing and storage, to create coordinated large databases, sectoral and branch registers, etc.
- Possibility of global unification of management procedures and documents at different levels of administrative and territorial management.
- Ability to form clear measuring criteria for quality provision of administrative services and socially significant indicators of the effectiveness of the state's power institutions.

At the same time many experts and scientists warn about the existence of considerable threats that processes of digitization and transfer of state and municipal management systems into the format of digital governance carry. In particular, such threats include:

- Polarization of personnel according to the level of digital skills possession. This increases risks of inconsistency of high-quality educational and professional knowledge, skills of personnel with requirements and needs of the labor market.
- Deepening of social polarization of society, sphere narrowing of the formation and implementation of the middle class, blocking of social elevators and regressive social mobility of the population. Processes related to the precarization of the economically active population, the country's loss of labor potential due to the growth of labor migration require special attention.
- Emergence of socio-psychological problems in individual and society as a whole. They are related to the segregation threats of the country's population according to the criteria of their competences in digital technologies, deterioration of the functional capabilities and work skills of the personnel, and changes in motivational orientations.
- Threat of lag deepening of the economy of Ukraine in terms of digitalization degree not only from developed countries but also from countries with a transformational economy.
- Lack of significant impact of public administration digitization in the economic sphere on the growth of industrial production, increase in digital added value and GDP. This is due to the fact that in Ukraine there is a process of "consumption digitalization" (due to high-tech imports and digital services) and not domestic production of products and services related to the digital economy [17].
- Inevitability of personnel optimization of the public administration apparatus, especially at the middle and higher management levels caused by incompetence of large part of the old personnel in the field of digital technologies and the devaluation of their competences. Digital transformation of public administration requires managers at all levels of government acquainted with relevance and the importance of key factors of digitization [18].

In our opinion, this list should be supplemented with the following possible threats:

- Increase in unemployment and reduction of jobs in the labor market due to the increasing automation and robotization of production processes. This leads to the reduction of workers, especially of medium and low skill levels. Thus, number of traditional professions is predicted to disappear in the coming decades.
- Reduction of state control over economic activity and compliance with all legislative, especially tax requirements as a result of the increasing movement into the global information space of the ways of sale, consumption and exchange of goods and services.
- Polarization of the world due to the increase of "digital divide" between the leading developed countries. This concentrates the latest information and communication technologies in their hands. Majority of remaining ones are unable to develop and implement the latest information technologies at the same level due to their scientific and economic potential.
- Coming to the leading roles of the phenomenon of cybercrime. These are illegal actions against public, financial and business information, capable of disabling the

information infrastructure of the state and paralyzing certain spheres, industries or directions of state administration and economic activity.
- Legal framework lagging from the rapid development of increasing number of the latest ICT technologies and various startups. In particular, those are capable to harm safety of society's vital activities due to the inertia of legislative process and its reactive nature in relation to problems accumulation in public-power relations.
- Marginalization of society part due to the complete loss of competitiveness of citizens who are unable to master modern information and communication technologies due to their old age, educational level, mental abilities, lifestyle, inability to have a personal computer and pay for the Internet, etc.
- Growing inconsistency of national education systems of citizens as one of the most conservative institutions of society due to the inability to quickly and flexibly change educational programs in accordance with the rapid transformation of tools, services, programs and means of the information and communication environment.

Traditional SWOT analysis gives opportunity to consider advantages and disadvantages in a generalized form. It makes possible to form a matrix of relevant factors and take into account both strengths and weaknesses of the institution itself or the process being analyzed, favorable and unfavorable factors of the external environment. In particular, such SWOT analysis will look as follows with regard to digitalization of public administration systems (Fig. 1).

Digital transformation of public administration systems is not just the automation and optimization of certain processes of the implementation of state functions. It also includes provision of state services, implementation and use of certain modern ICT in the interests of ensuring activities of the state bodies. Digital transformation is designed to qualitatively change content of state administration in including its separate procedures, stages of the management cycle, state functions, their composition and types. Such change should lead to increase in the quality of state administration: providing greater justification for state intervention (and reducing role of the state as a whole) [13].

It is believed that digital transformation and "digital governance" or "smart government" (by analogy with the latest concepts of Smart Home or "smart house" and Smart Town or "smart city") will transfer the vast majority of government and public management services to purely digital format. It will completely exclude participation of civil servants from this process at any stage, automate and significantly speed up the process of receiving any administrative service by a citizen. Only philosophy of public administration will be changed. It will be coming out from administration and wide use of the toolkit of "service-oriented interaction of public authorities" and the citizen. It evolves from informatization to digitalization of state administration and local self-government. In the same time the concept of "electronic government" is positioned as an intermediate stage of modern management transformations [10].

Modern researchers single out three main global trends in digitalization of public administration systems:

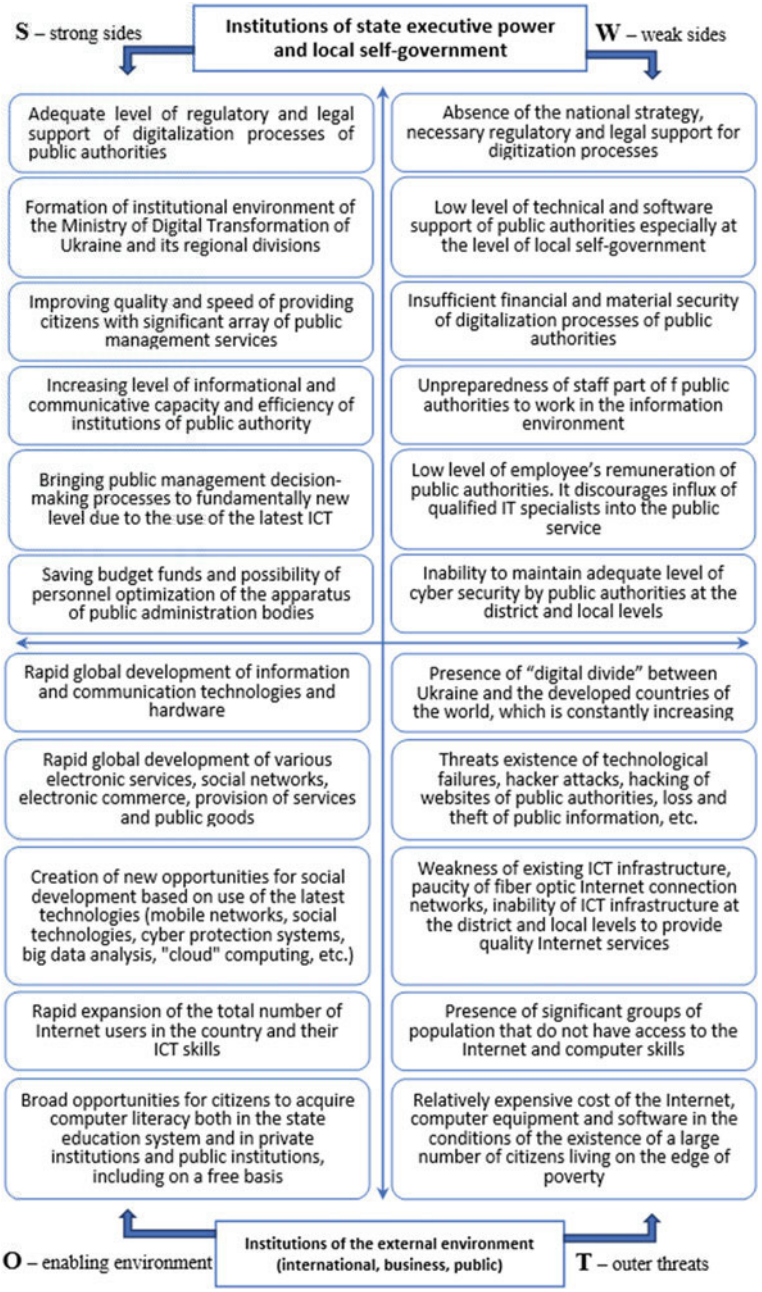

Fig. 1 SWOT analysis of digitalization factors of public administration systems in Ukraine

The first (in the field of public administration) is digitalization of state administration and local self-government bodies in terms of optimizing their procedural activities, record keeping, interaction with other structures and institutions of the country's public administration system. This makes possible to automate significant part of the document flow, reduce time spent and number of excessive processes of current administrative activities of civil servants, and improve the quality of their work.

The second (in the field of public policy) is digitization of interaction of public administration bodies with public organizations and citizens, expansion of administrative services provided online without the intervention of public administration officials, expansion of the range of online tools for the participation of citizens and their organizations in direct public administration processes, in particular, various forms of online democracy. This makes possible to significantly reduce time and costs for citizens to receive administrative services, to establish close feedback with territorial communities, to consult with them on key issues of local development, to involve citizens in joint actions. It cumulatively leads to increase in the level of legitimacy of public governance bodies.

The third (in the field of state regulation) is digitalization of interaction between state administration bodies and business on the principles of "single window" and automation of various types of permit procedures with removal from their granting of the presence of officials of state bodies as a factor of subjectivity and potential corruption. This is intended to provide new incentives for development of market relations and revitalization of the national market. Therefore, the state institutions must make strategic investments in ICT in conditions of digital markets and economies formation when citizens become actual users of technology. Otherwise, they will be insufficiently prepared for new models of interaction and service. They will become hostages of old, unstable in the long term management models. Slow, procrastinating adoption of technological innovations in the "digital" era in general exposes risk of fulfilling tasks and achieving goals by state institutions, their costs increase, inefficiency increases, they increasingly become structures that do not meet the challenges of the times [19].

It should be noted that Ukraine is only at the initial stage of the third stage or rather at the stage of its announcement, but not the transition. Thus, in 2016 the program "Digital Agenda of Ukraine 2020" was developed. It was adapted to the Digital Agenda of the European Union and provided for transition to digitalization of state administration and the country's economy. Mission of this program was the slogan: "Digital technologies are the basis of Ukraine's well-being; sphere that defines the essence of transformations in the country—for a better life, work, creativity, education, recreation" [19]. In particular, in the course of the digitization of public administration the following ICT platforms are implemented:

– Digital transformation of administrative services—more than 120 types of services are provided electronically and are available on the official websites of public authorities. They actively use leading technologies of digitalization of